



MAINTENANCE MANUAL

Manual No.: M-30TR-MM1

Issued: October 1999

Pages 1-40

M-30TR SYSTEM

SOLID STATE REFRIGERATOR
BIOMEDICAL, DRUGS AND WHOLE BLOOD

REFRIGERATOR M-30TR P.N. A-7244

POWER SUPPLY P.N. A-7160

BASKET ASSEMBLY P.N. A-2420

POWER CABLE ASSEMBLY A-2089

BATTERY PACK ASSEMBLY A-2321

NSN # 4110-01-451-2356

NATO # 4310-99-770-7126

1550 west Carroll Avenue Chicago, IL 60607-1012
TELEPHONE: (312) 666-9966 FAX: (312) 666-9977

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THERMOPOL INC.
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Section 1
M-30TR Description and Operation

1-0. Unpacking the M-30TR

1. Inspect shipping box immediately for evidence of damage.
2. Stand the carton upright. (Note arrows)
3. Cut the plastic packing bands.
4. Pull up all top cover's flaps of shipping box.
5. Pulling from the top, lift the M-30TR out of shipping box.
6. Open unit, and remove all inside contents.
7. Verify contents to include:
 - 1 - Power Supply (P.N. A-7160)
 - 2 - Maintenance Manuals (P.N. M-30TR-MM1)
 - 2 - Operational Manuals (P.N. M-30TR-OP1)
 - 1 - Wire Basket (P.N. A-2420)
 - 1 - DC Power Cable (P.N. A-2089)
 - 1 - Battery Pack (P.N. A-2321)
 - 50 - Temperature Charts (P.N. P-2415-C)
8. Inspect contents immediately for damage.

If the unit or contents are defective or damaged, contact factory within 24 hours.

Phone: (312) 666-9966

Fax: (312) 666-9977

or notify in writing to:

Thermopol Inc.
1550 West Carroll Avenue
Chicago, IL 60607-1012

1-1. General

The M-30TR is a solid state refrigerator/heater unit designed to keep the contents of the load compartment at the ideal blood storage temperature (4°C) over the operational ambient range.

The unit does not require fans, motors, gas or air pressure. Cooling is performed by thermoelectric technology.

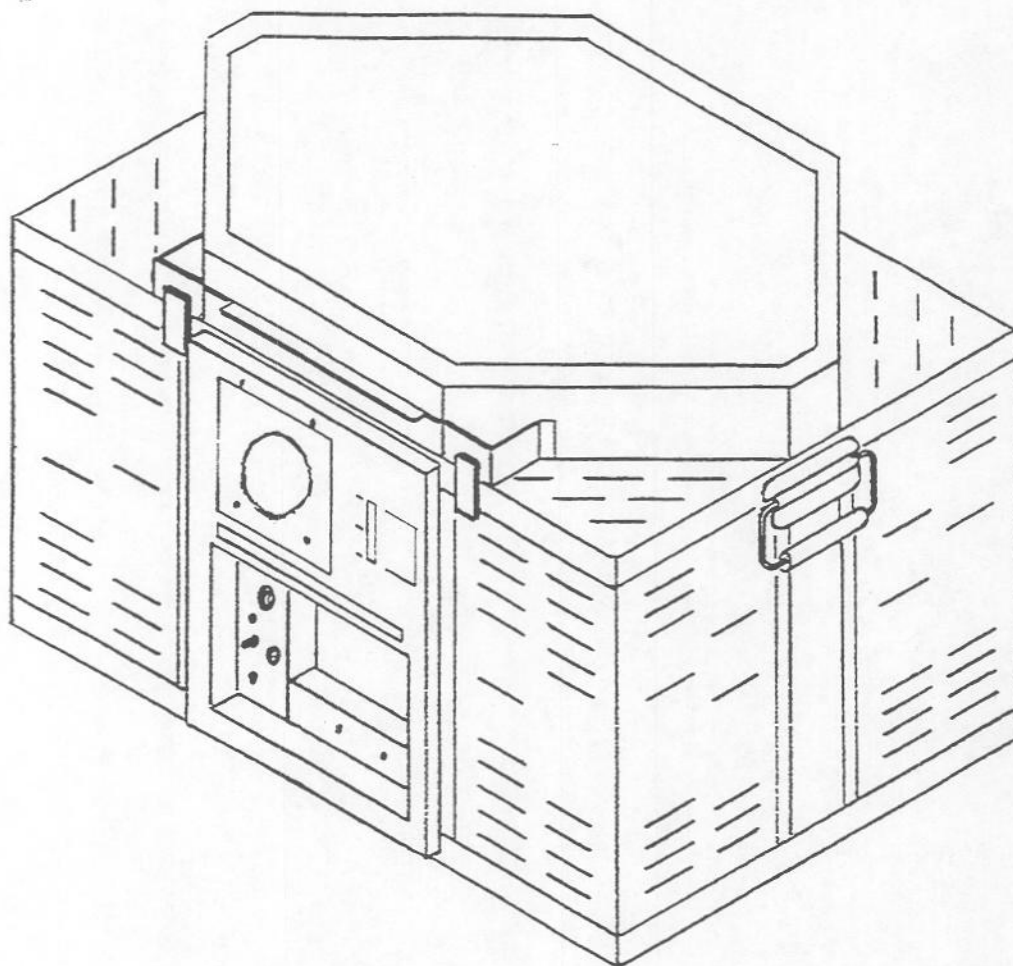


Figure 1
M-30TR Storage and Transportation Refrigerator

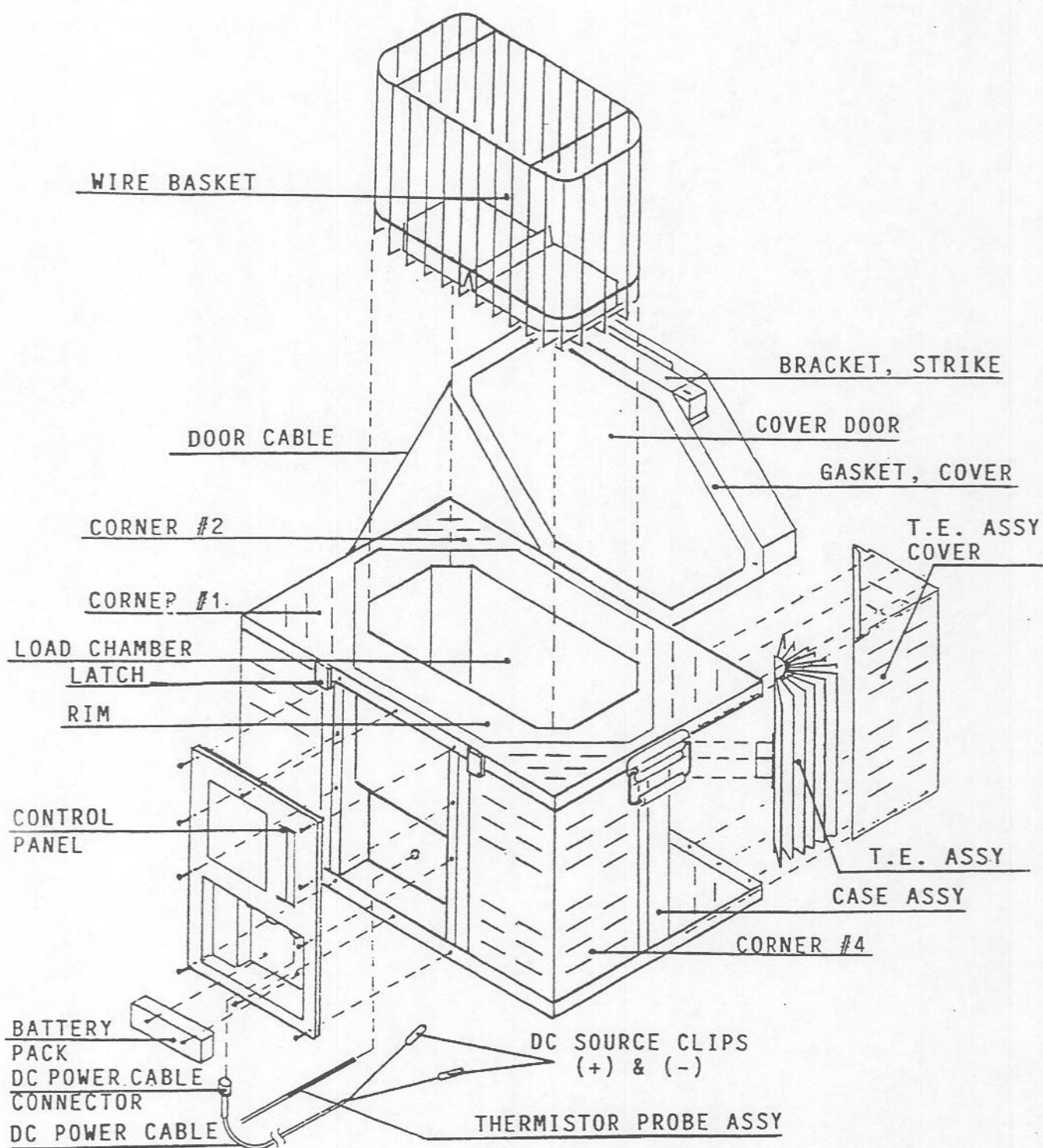


Figure 2
M-30TR Exploded Front View

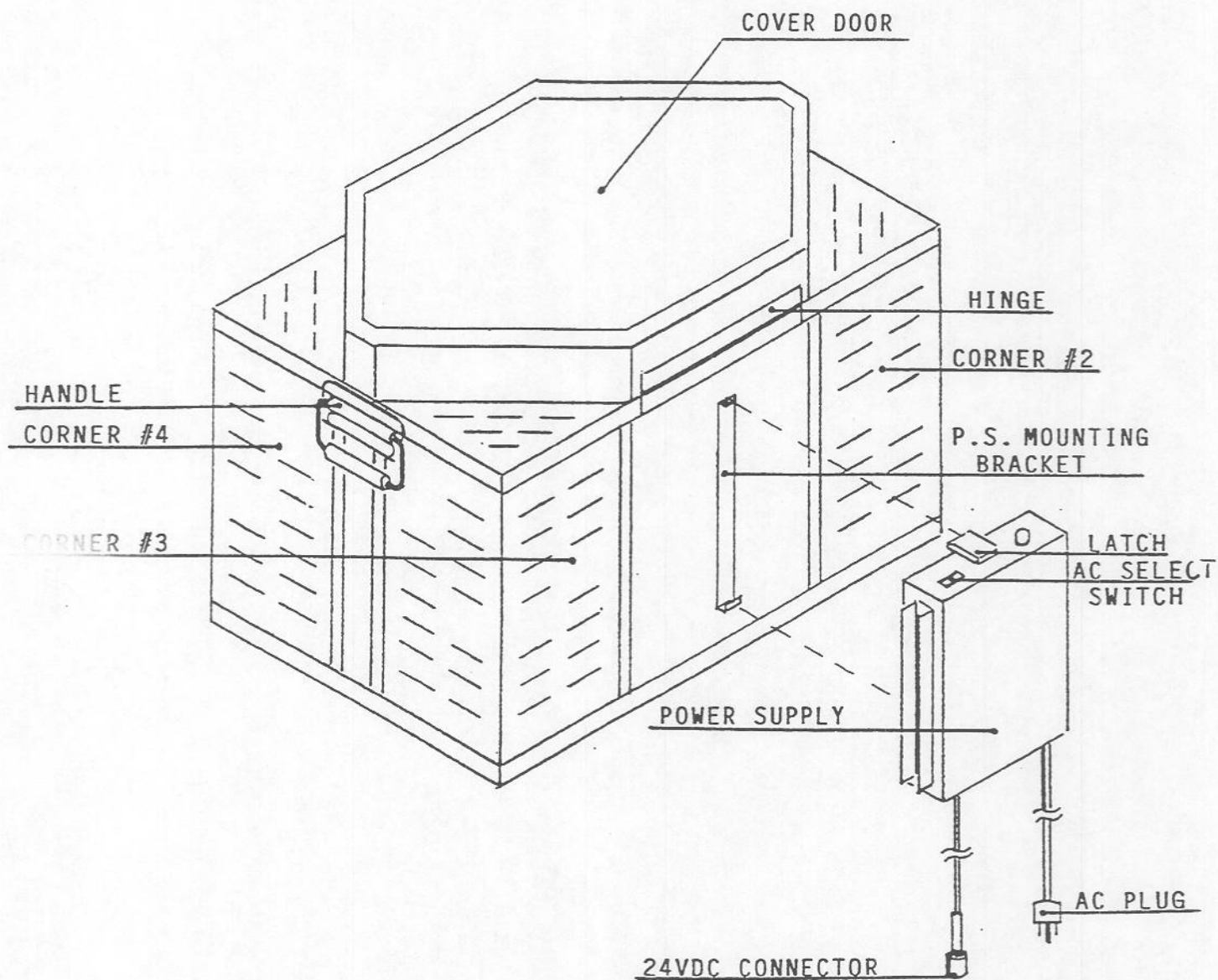


Figure 3
M-30TR Exploded Rear View

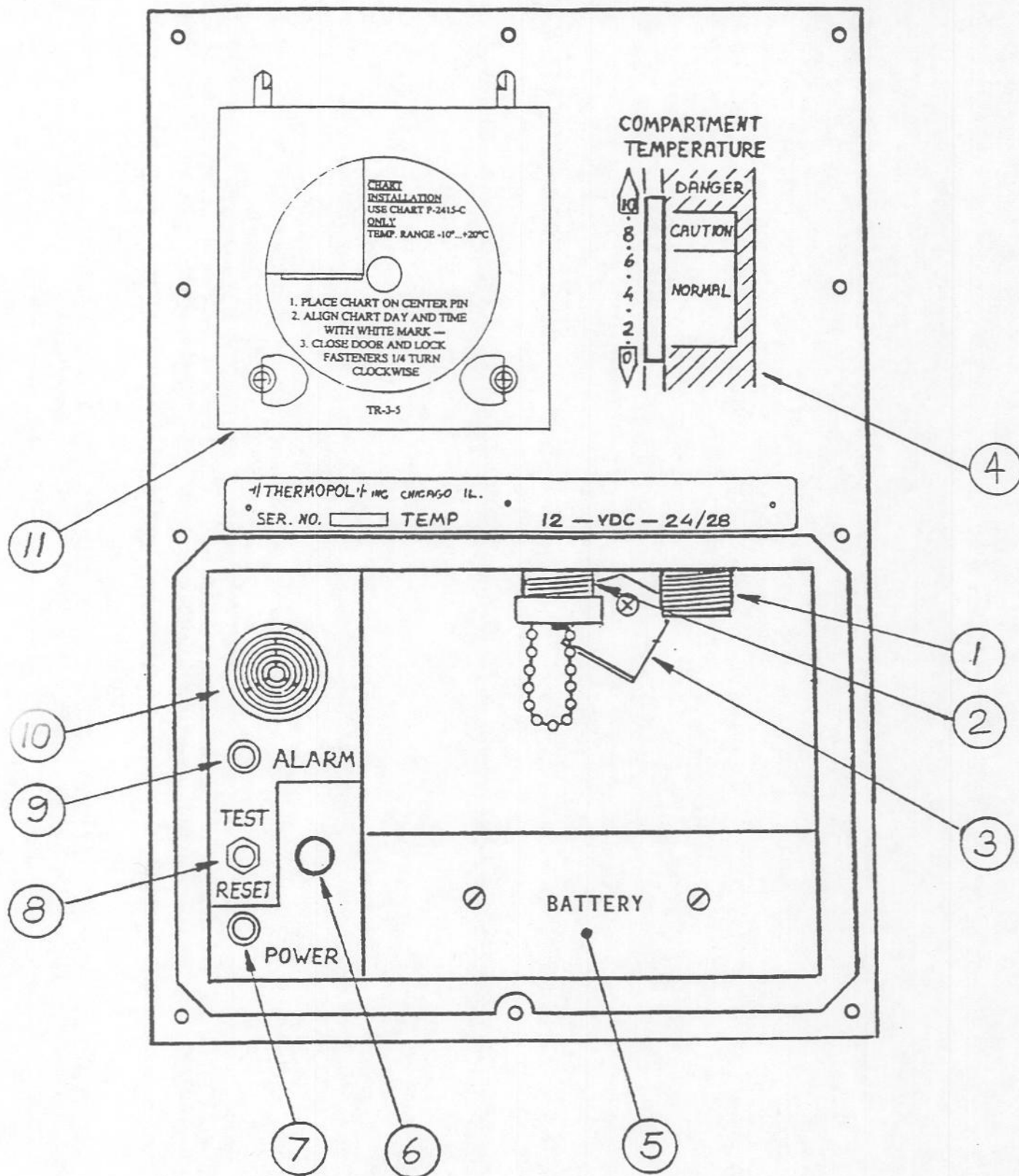


Figure 4
M-30TR Control Panel

M-30TR Control Panel Function Description

Item	Function/Description
1	24/28VDC POWER RECEPTACLE. Connects a 24/28VDC power source through power cable (PN A-2089). Alternatively, connects power supply (PN A-7160).
2	12VDC POWER RECEPTACLE. Connects a 12VDC power source through power cable (PN A-2089).
3	INTERLOCK. Prevents plugging in two connectors at the same time.
4	THERMOMETER. Color coded display of compartment temperature. Red for DANGER ZONE 0°C (32°F) and below; 10°C (50°F) and above.
5	BATTERY PACK. Standby power for recorder, thermometer and alarm during power failure. (Continuously recharging).
6	CIRCUIT BREAKER. Provides overcurrent protection, push to reset.
7	POWER INDICATOR. Lights green when unit is properly powered.
8	ALARM TEST/RESET SWITCH. Push up for testing, push down for resetting.
9	VISUAL ALARM SIGNAL. Blinks red when alarm is activated.
10	AUDIO ALARM SIGNAL. Beeps when alarm is activated.
11	RECORDER. Hard copy temperature recorder operates at 1 turn per week.

1-2. Description and Specifications

The unit is a modified commercial blood and vaccine transportation unit designed for operation in harsh environments.

The M-30TR operates on 12VDC or 24-28VDC and can be plugged into a 115VAC or 230VAC main, through a rectifier power supply. The power supply can be mounted on the unit. The M-30TR inner capacity is approximately 1³ foot and it can accommodate 30 blood bags of 450ml.

M-30TR SPECIFICATIONS

Electrical Specifications for the M-30TR are listed below:

Voltage	Current
12VDC Nominal	7 Amps Max.
24/28VDC Nominal	3.5 Amps Max.
120VAC, 50Hz	1.6 Amps Max.
120VAC, 60Hz	1.6 Amps Max.
220VAC, 50Hz	0.8 Amps Max.
220VAC, 60Hz	0.8 Amps Max.

Physical Dimensions

Outside	Inside
Width: 66cm (26in)	43cm (16.9in)
Depth: 48.9cm (19.3in)	21.6cm (8.5in)
Height: 47cm (18.5in)	30cm (11.8in)
Volume: 0.15 ³ M (5.4 ³ Ft)	28 Liter (1 ³ Ft.)
Weight: 31 Kg (68 lbs)	

1-3. Functional Description of the System

The Block Diagram as shown (Page 13 Figure 5), describes the functions of the components and their interrelationships, required for the operation of the M-30TR solid state refrigerator system.

The purpose of the M-30TR unit is to maintain a constant, preset compartment temperature of 2°C (35.6°F) to 6°C (42.8°F) for blood transportation and storage needs at ambient temperatures of -40°F to 120°F.

The M-30TR utilizes a solid state thermoelectric effect, in its heat pumping system. At high ambient temperatures, heat is pumped out of the compartment thereby cooling it. At low ambient temperatures, heating is achieved by reversing the pumped heat direction. The heat flow direction is controlled by the current direction in the solid state heat pumping system (module) to keep the compartment temperature constant. The temperature control automatically determines the duty cycle and direction of the heat pumped.

Sensor TUBE reacts to the load compartment temperature. It continuously provides the command signal to the temperature controller which in turn controls the alarm system, thermometer, recorder and temperature control of the load compartment.

Sensor BLOCK reacts to the heat pumping system temperature. It continuously provides the command signal to the temperature controller to prevent excessive cooling or heating of the heat pumping system.

The power input section provides the M-30TR with the power source voltage, by plugging the power cable of either the AC, via the power supply, or a DC source into the appropriate receptacle in the front panel, (Page 10 Figure 4). This section also provides the resetable overcurrent and reverse polarity protection.

The M-30TR alarm system, thermometer and recorder are powered by an independent NiCd battery pack to safeguard the temperature integrity of the compartment temperature. The thermometer measures and displays the compartment temperature. The recorder provides a hard copy chart of compartment temperature. The input signal is fed from Sensor TUBE which senses the temperature inside the load compartment.

An audio-visual alarm is triggered when the temperature inside the compartment falls outside the acceptable range of 2°C (35.6°F) to 6°C (42.8°F). The alarm is manually resetable. The alarm can be tested using the test switch S1. This DPDT switch is depressed upwards to put the system into TEST mode. In this mode, all thermometer LEDs light momentarily, and the audio visual alarm is activated. To RESET the system, push switch lever down. The alarm will automatically be set ON.

The alarm system, the thermometer and the recorder are powered by a continuously recharging NiCd battery pack P.N. A-2321, for standby operation during a power failure. The NiCd battery pack is a 7.2 VDC pack and is continuously charged by the front panel of the refrigerator.

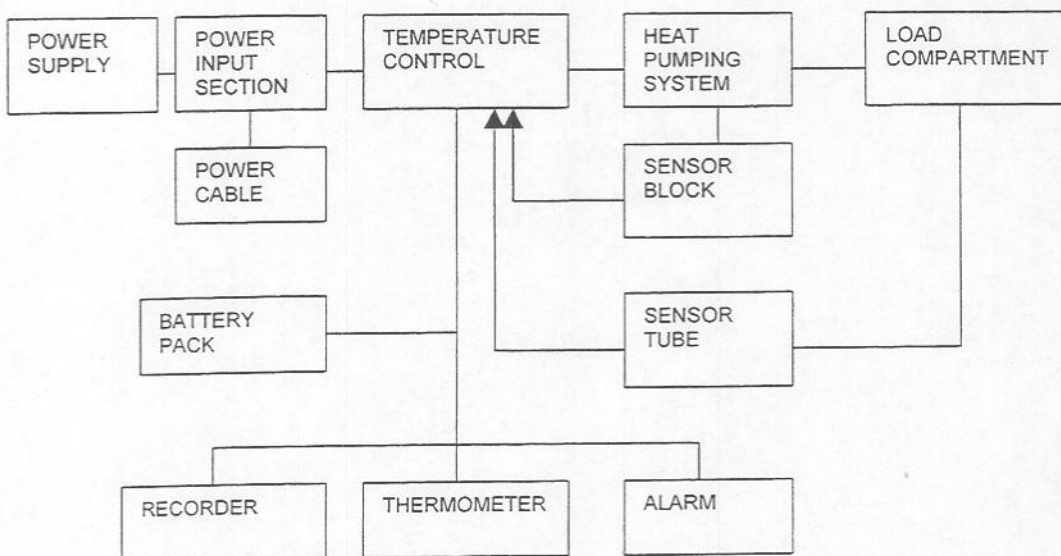
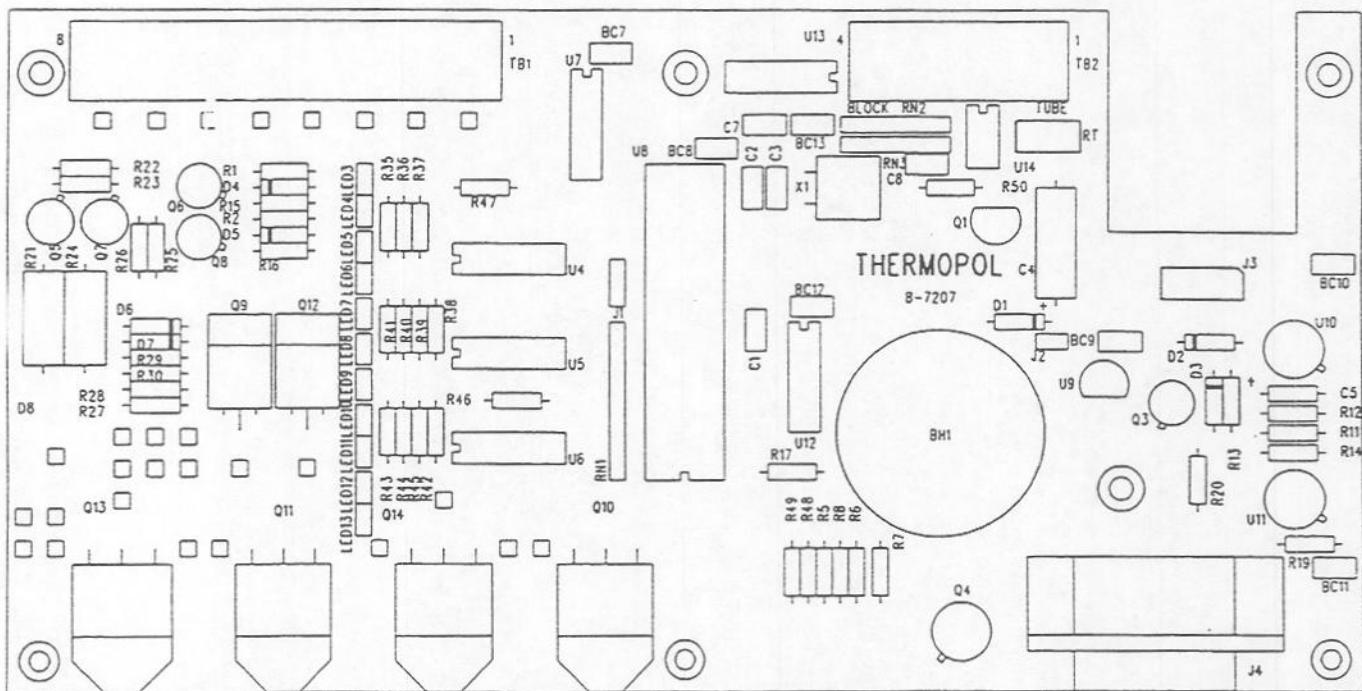


Figure 5
M-30TR Block Diagram

The Control Board B-7207 Figure 6, provides the (A) temperature control, (B) thermometer (C) alarm and (D) recorder functions for the M-30TR. The board is mounted on the inside of the Control Panel. The four schematic diagram sections are as follows:

(A) Temperature Control Section	Page 16, Figure 7
(B) Thermometer Section	Page 17, Figure 8
(C) Alarm Section	Page 18, Figure 9
(D) Recorder Section	Page 19, Figure 10



C - CAPACITOR
D - DIODE
P - POTENTIOMETER

Q - TRANSISTOR TE
R - RESISTOR U
RN - RESISTOR NETWORK

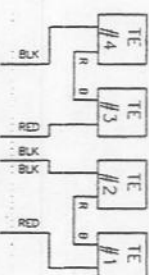
TB - TERMINAL BOARD
U - INTEGRATED CIRCUIT

Figure 6
Component Placement B-7207

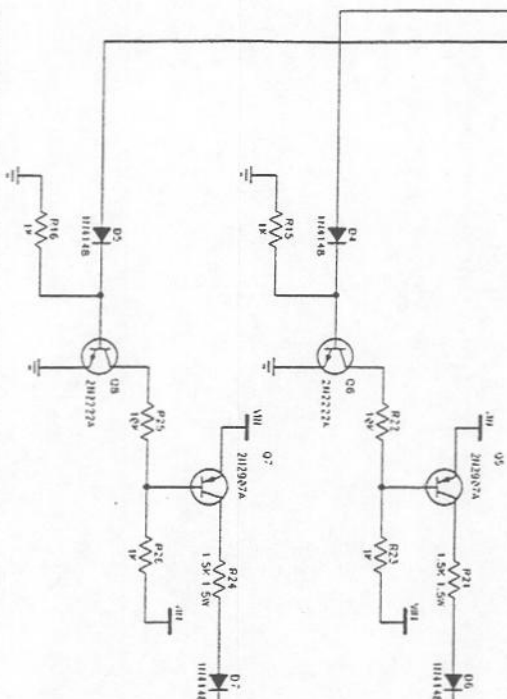
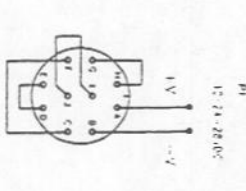
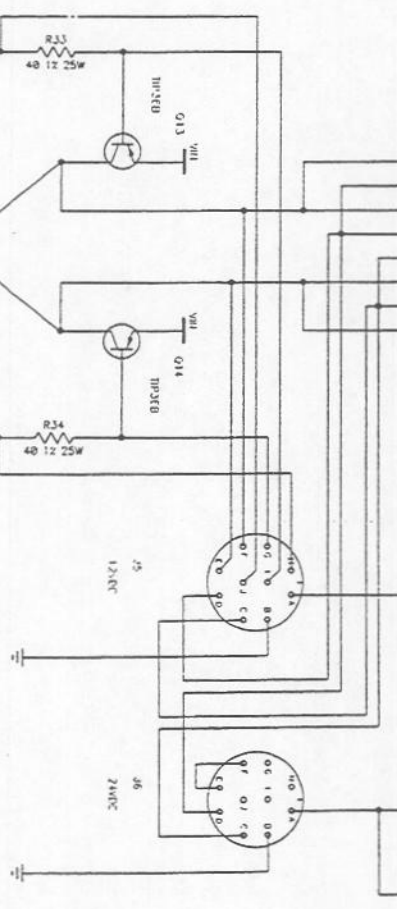
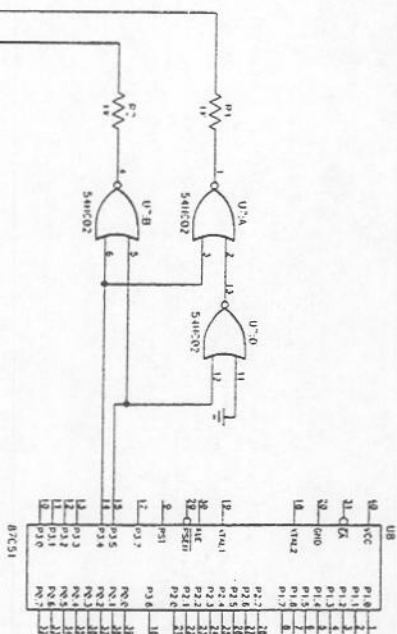
1-5. Electronic Parts List, B-7207

R1,R2,R15,R16,R17,R20,R23,R26	RES	1K	5%	1/4W
R5, R6, R49	RES	100	5%	1/4W
R7,R8,R13,R22,R25,R46, R47, R48	RES	10K	5%	1/4W
R11	RES	1.50K	1%	1/4W
R12	RES	249	1%	1/4W
R14	RES	39	5%	1/4W
R19	RES	2.2K	5%	1/4W
R21, R24	RES	1.5K	5%	1.5W
R27, R30	RES	22K	5%	1/4W
R28, R29	RES	4.7K	5%	1/4W
R31, R32	RES	12	1%	25W
R33, R34	RES	40	1%	25W
R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45	RES	470	5%	1/4W
R50	RES	1600	5%	1/4W
D1,D4,D5,D6,D7	DIODE	1N4148		
D2	DIODE	1N4001		
D3	DIODE	MBR030		
D8	DIODE	MBR3545		
TB1	CONNECTOR	8 PIN		
TB2	CONNECTOR	4 PIN		
Q1	TRANSISTOR	TN0604N3 - Supertex		
Q3, Q6, Q8	TRANSISTOR	2N2222A		
Q4	TRANSISTOR	2N2219		
Q5, Q7	TRANSISTOR	2N2907A		
Q9, Q12	TRANSISTOR	TIP 121		
Q10, Q11	TRANSISTOR	TIP 35B		
Q13, Q14	TRANSISTOR	TIP 36B		
C1	CAPACITOR	1.0uF		
C2, C3	CAPACITOR	18pF		
C4	CAPACITOR	10uF		
C5	CAPACITOR	1.2uF		
U4, U5, U6	IC	LM124J		
U7, U12	IC	54HC02		
U8	IC	TN87C51		
U9	IC	LP2950CZ-5.0		
U10,U11	IC	LM117H		
U13	IC	ADC0834CCN		
U14	IC	LM158J		
RN1	RESISTOR PACK	100K X 10 SIP		
RN2,RN3	RESISTOR PACK	10K X 7 SIP		
BC7, BC8, BC9, BC10, BC11, BC12, BC13, C8	CAPACITOR	0.1uF 25Volt		
X1	CRYSTAL	3.579545MHZ		
J3	CONNECTOR	10 PIN HEADER		
J4	CONNECTOR	15 PIN D-SUB		
LED3, LED13	LED	RED		
LED4, LED5, LED6, LED7,	LED	YELLOW		
LED11, LED12, LED8, LED9, LED10	LED	GREEN		

THERMOELECTRIC MODULES



THESE PARTS NOT ON PCB
USE VIA HOLES TO CONNECT TO PCB



THERMOPOL			
GRAPHIC TITLE	TEMPERATURE CONTROL SECTION		
PART NUMBER	S-7205	DATE	11-16-97
DESIGNER	A	APP'D BY	
FILE NAME	SHEET 1 of 1		

Figure 7
Temperature Control Section, Schematic S-7205

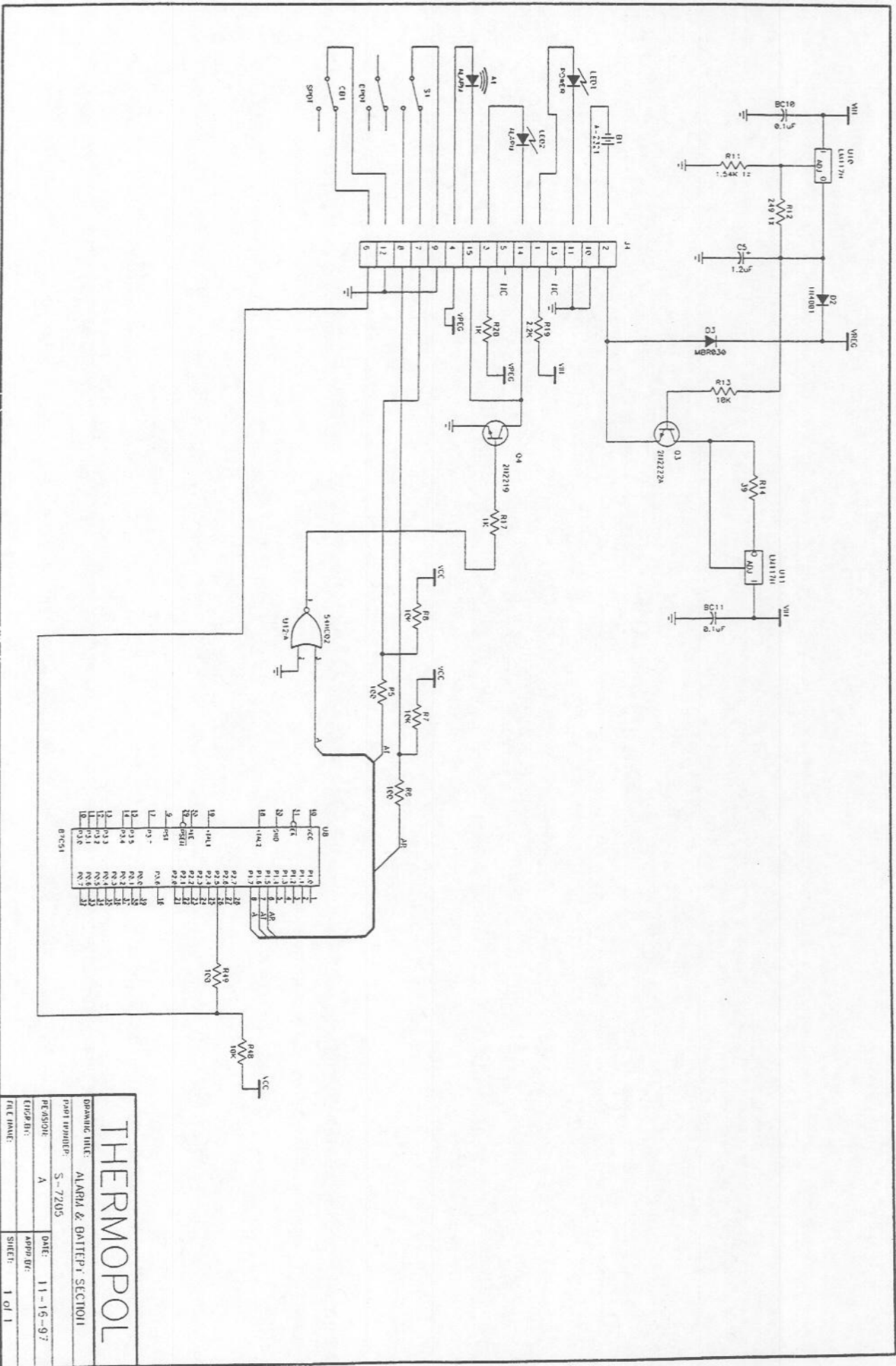
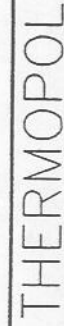


Figure 9
Alarm Section, Schematic S-7205



PART NUMBER: _____

TEMPERATURE RECORDER SECTION

ENGR BY:	A	DATE: 11-16-97
APP'D BY:		

FILE NAME:	SHEET: 1 of 1
------------	---------------

19

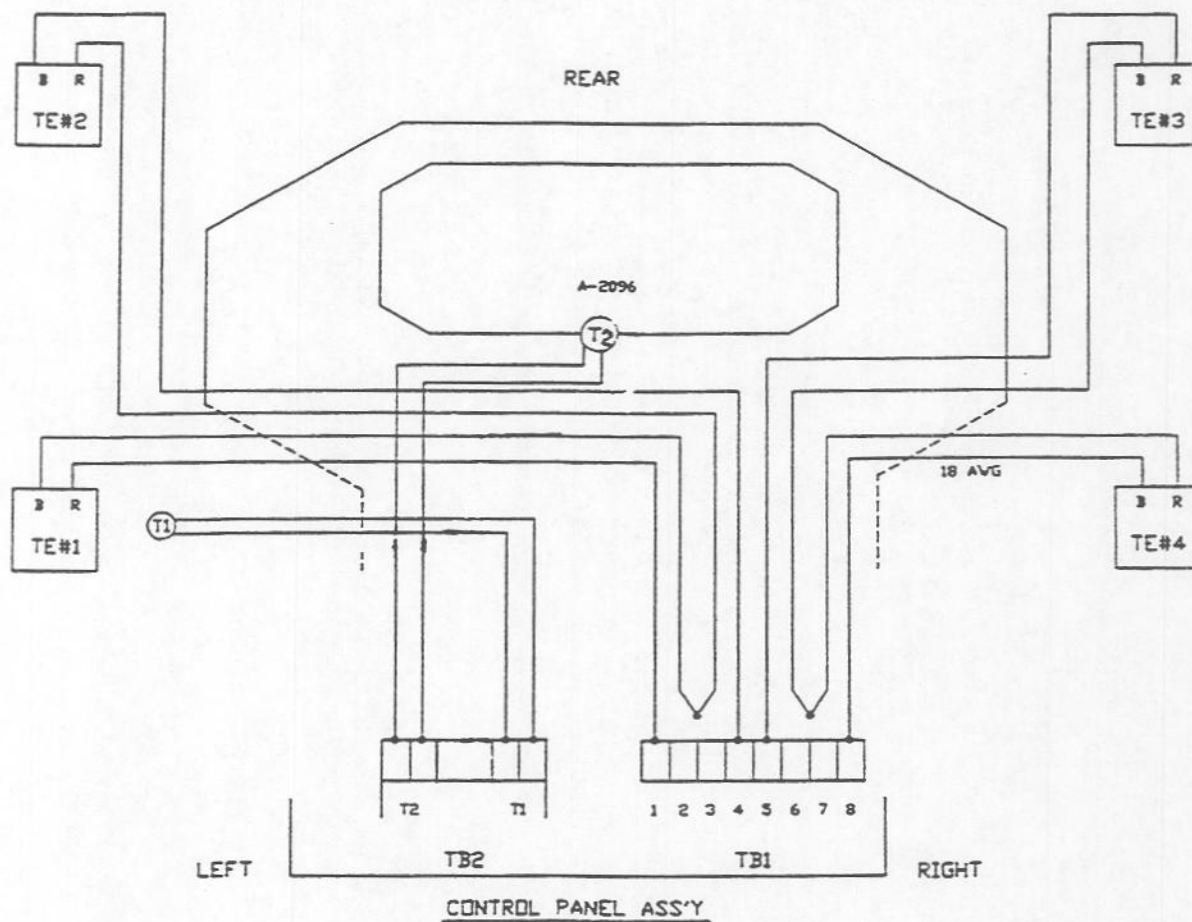
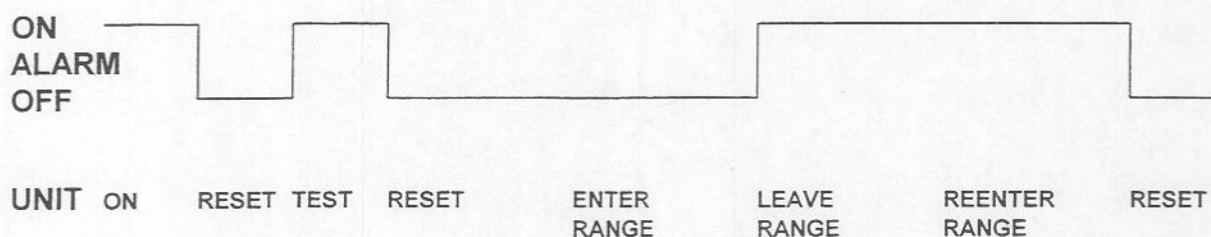


Figure 11
M-30TR, Wiring Diagram

1-6. Alarm Section Logic - Diagram A

The microcontroller is programmed to send an alarm signal when power is initially supplied to the unit. Once the initial alarm has been reset, it can be tested at any time by manually depressing the test switch to TEST mode. The alarm system will be set to monitor mode only once the load compartment temperature has entered the acceptable range of 2°C to 6°C. The alarm will remain off as long as the compartment temperature is within the acceptable range. Once the load compartment temperature falls outside the acceptable range of 2°C-6°C, the alarm will be automatically triggered. It will remain on regardless of the load compartment temperature until the system is reset by manually depressing the test switch lever to RESET mode.

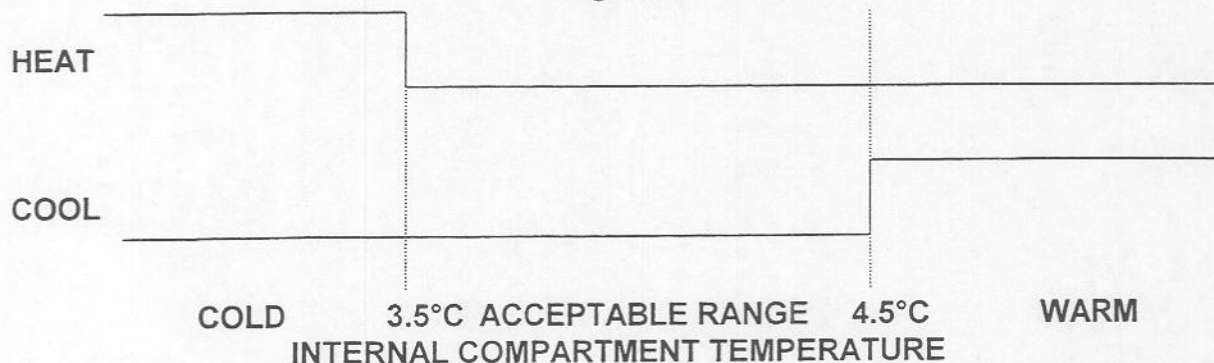
Diagram A



1-7. Temperature Control Logic – Diagram B

The temperature control of the M-30TR is achieved through the use of a microcontroller. The microcontroller is programmed to maintain the compartment temperature between 3.5°C and 4.5°C. When the load compartment temperature is below 3.5°C, the microcontroller provides a HEAT command. When the load compartment temperature is above 4.5°C, the microcontroller provides a COOL command. During periods when the unit is within the acceptable temperature range, the microcontroller provides neither a COOL nor a HEAT command and remains on monitoring standby.

Diagram B



Section 2

Preventive Maintenance

2-0. General

Since the M-30TR is a Solid State device, it is virtually maintenance free, and there is only one preventive maintenance task to perform:

KEEP THE UNIT CLEAN

The inside compartment should be cleaned at the user's discretion. Ordinary soap and water are generally sufficient for cleaning the compartment. For extra soiled areas, stronger safe household detergents may be used.

To insure continued efficient cooling performance of the unit, the T.E. Assemblies, located in the four corners of the unit, See Page 8 Figure 2, should be cleaned at one year intervals. Use an air hose to blow any accumulated dirt and debris from the heat sink fins.

Note: Cleaning materials are not provided with the unit.

Section 3 Troubleshooting

CAUTION: Troubleshooting and maintenance to be performed by qualified personnel only!

3-0. General

The M-30TR is a highly reliable instrument. However, if the M-30TR does not operate to specifications, visually inspect the unit for obvious causes. If a visual inspection fails to reveal the source of the problem, use the troubleshooting list in this section as an aid in locating and correcting the problem.

Before attempting to troubleshoot any malfunction of the M-30TR, make sure the power source is correctly connected.

The M-30TR is designed to provide the optimal internal load temperature without any adjustments. To insure proper functioning, simply make sure the internal compartment is stable at 4°C and observe that the recorder, thermometer and alarm system are functioning properly.

List of required tools for troubleshooting the M-30TR unit

Philips head screwdriver (#2)

Flat screwdriver (medium)

Multimeter

Side cutters

Wire stripper

For AC power: Check to verify voltage selector switch of the power supply is set to correct main voltage outlet 115VAC or 230VAC.

Important Note: The power supply must be connected to the 24/28VDC plug of the M-30TR. See Page 32 Figure 14.

For DC power: Use Power Cable A-2089, supplied with the unit, to connect the M-30TR to your DC source (12VDC or 24/28VDC).

Important Note: Connect Red clip (+) to Positive and Black clip (-) to Negative.

3-1. Troubleshooting List

I. Unit does not function. Green Power indicator light is OFF, (Page 10 Fig. 4)

- | | |
|-----------------------------------|--|
| 1. Power Circuit Breaker OFF | Push back RESET button. |
| 2. Connection faulty | Check connections and polarity.
Correct if necessary. |
| 3. Power does not get to the unit | Check and correct continuity of
the Power Cable. |

II. Unit does not function. Green Power indicator light ON.

- | | |
|--|---|
| 1. Source voltage is not
corresponding to the
selected operating
voltage. | Check and correct voltage setting
of the AC selector switch of the
power supply . |
| 2. Source is incapable to
supply the required
current. | Use appropriate power source.
AC - 115 or 230 Volts
DC - 12 or 24-28 Volts. |

III. Unit does not perform to specifications.

- | | |
|--------------------------|--|
| 1. Faulty Module. | Check current draw.
Normal 2.5-3 Amps at 24VDC.
If outside limits, locate and
replace faulty T.E. Assembly.
(Page 27 Section 4-2.) |
| 2. Faulty Control Board. | Check voltage between wire #1 and #8.
Voltage should be between 24-32VDC.
If outside limits, replace board. |
| 3. Faulty Thermistor. | Check resistance of thermistor TUBE
and thermistor BLOCK. Resistance
measured should be 3K Ohm at 25°C
(77°F). |

NOTE – Thermoelectric assemblies, thermistor assemblies, power cable assemblies, power supplies and control boards are all replacement parts supplied as complete assemblies.

Section 4 Corrective Maintenance

4-0. General

The procedures given below, describe how to locate, remove and replace defective components of the M-30TR.

List of tools required to replace defective components of the M-30TR.

- | | |
|---------------------------------|--------------------------------------|
| (1) 18-22 Gauge wire connectors | (2) Rivetting Gun (Pop) |
| (3) Conductive Grease | (4) Non-conductive Silicone Adhesive |
| (5) Hand Drill 1/4" Chuck | (6) 1/8" Drill Bit |
| (7) Hand Crimping Tool | (8) Phillips #2 Screwdriver |
| (9) 6 VDC Power Supply | (10) 12 VDC Power Supply |
| (11) Multimeter | (12) Soldering Gun |

4-1. T.E. Assembly - Trouble Location

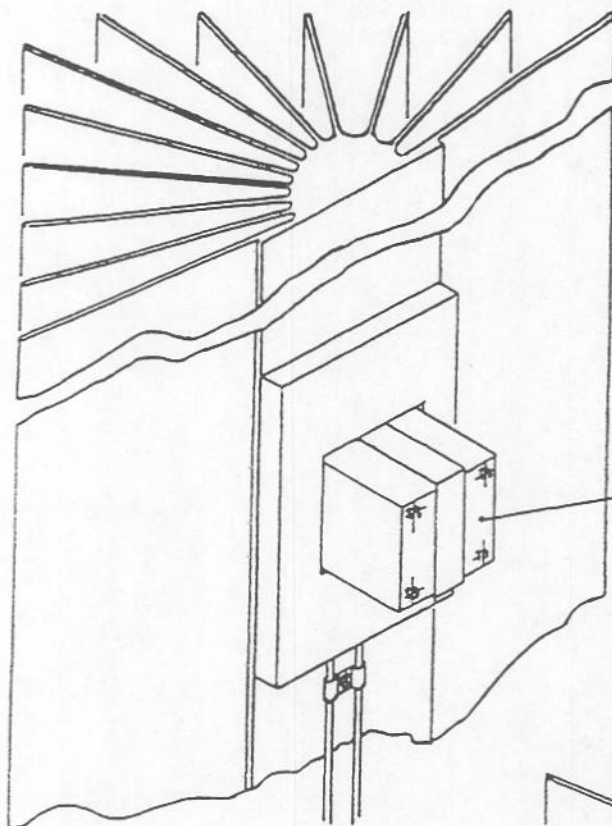
Before proceeding with the following Diagnostic procedure,

MAKE SURE THAT THE GREEN POWER LIGHT IS ILLUMINATED AND THE CIRCUIT PROTECTOR IS PUSHED IN.

A. Locating defective T.E. Assembly.

1. Remove the 10 screws securing the control panel to the unit.
2. Carefully pull the Panel back by 1/2 inch, top end only, to expose the Terminal Block TB-1.
3. Disconnect wires 1 and 4 from TB-1 and connect them to a 12VDC power source, the current reading should be 2-3 Amps.
4. Repeat Step 3 with wire pair 5-8.
5. Determine the pair with the defective T.E. Assembly.
6. Cut the connection between the two T.E. Assemblies behind the control panel. Wires 2-3 or 6-7 respectively.
7. Connect a 6VDC power source to the leads of each T.E. Assembly between 1-2; 3-4; 5-6; 7-8. The current reading should be 2-3 Amps.
8. Determine the defective T.E. Assembly.

Note: T.E. Assembly #1 Page 26 Figure 12 (PN A-7437 contains Thermistor BLOCK).



T.E. ASSEMBLY
PN A-2436
CORNER #2, 3 and 4

NOTE:
A- TOP SURFACE OF MODULE SUPPORT

T.E. ASSEMBLY
INCLUDING THERMISTOR T1
PN A-7437
CORNER #1

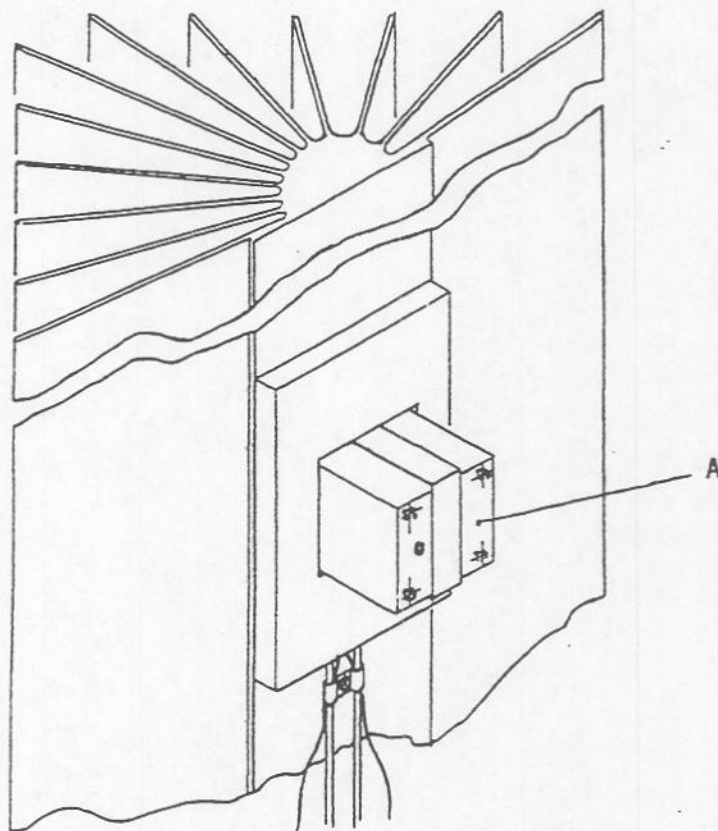


Figure 12
T.E. Assembly

4-2. T.E. Assembly - Corrective Procedure

A. Removal of A-2436 Corner #2, 3 and 4

1. Remove the 10 screws securing the control panel to the unit.
2. Carefully pull the panel back by 1/2 inch, top end only, to expose the Terminal Block TB-1.
3. Disconnect wires from TB-1.
4. Cut wire connector between wire number 2 and 3; or 5 and 6.
5. Drill out 10 pop rivets, securing the corner cover to the unit. Use a 1/8 inch diameter drill. Remove corner cover.
6. Remove the 4 screws located inside the cooling compartment securing the defective T.E. Assembly.
7. Remove the T.E. Assembly from the unit, pulling the red and black wiring out of the insulation foam. See Page 8 Figure 2.

B. Removal of A-7437 Corner #1 with Thermistor BLOCK

1. Repeat steps 1-7 in above section.
2. Disconnect 2 wires of BLOCK from TB2 on front panel.
3. Remove the T.E. Assembly from the unit, pulling the red and black wiring along with thermistor (BLOCK) wires out of the insulation foam.

C. Removal of Thermistor TUBE; Part Number A-7223

1. Remove the 10 screws securing the control panel to the unit.
2. Carefully pull the Panel back by 1/2 inch, top end only, to expose the Terminal Block TB-2.
3. Disconnect 2 wires at front panel from TB-2.
4. Push Stainless Steel tube, located inside the load compartment, through insulation and out of the refrigerator.

4-3. Replacement of T.E. Assembly

A. Replacement of T.E. Assembly A-2436 - Corners #2, 3 and 4

1. Thoroughly wipe clean the top surface of the module support (Page 27 Figure 12) and the mounting surface in the corner mounting cavity.
2. Apply a thin, uniform film of conductive grease to the top surface of the module support and to the mounting surface.
3. Thread the T.E. Assembly red black lead wires through the insulating foam, into the front panel cavity.
4. Position the T.E. Assembly in the mounting cavity, and tighten four screws from the inside of the load compartment.
5. Splice the T.E. Assembly's leads, and apply crimp connector over the leads.
6. Splice wires 2 to 3 and 5 to 6 using crimp connector.
7. Reconnect 1,4,5 and 8 wires to TB1.
8. Secure the corner cover with 1/8" pop rivets
9. Secure the front Control panel with 10 screws to the unit.

B. Replacement of T.E. Assembly A-7437 - Corners #1 with Thermistor BLOCK

1. Repeat steps 1-6 above.
2. Reconnect the 2 wires of Thermistor BLOCK to TB-2.
3. Repeat Steps 7-9

C. Replacement of Thermistor TUBE; Part Number A-7223

1. Insert new Thermistor TUBE unit through foam insulation into liner grommets.
2. Connect 2 wires of thermistor TUBE to TB-2.

4-4. Control Board – Trouble Location

The control board P.N. A-7205 is designed to control all aspects of the refrigerator. The temperature control, alarm, thermometer and recorder systems are all controlled by this board. If any of the board systems are found to be faulty, replacement boards are available as complete assemblies. Replacement of individual components on the board is not recommended.

Thermometer Section – The thermometer can be checked by lifting the TEST switch to the TEST position. As long as the lever is depressed upwards, all LEDs should be lit. If one or more LEDs are off, replace the control board.

Recorder Section – Before servicing a faulty recorder, check that the chart paper is inserted correctly. The paper, and the recorder compartment should be free of debris. If the recorder is not functioning after a thorough cleaning, replace board and stepper motor.

Alarm System– Test audio alarm signal C-4105 by disconnecting it from control board. Connect a 6VDC source to signal C-4105. If signal is audible, replace control board. If not, replace signal.

Temperature Control System – With unit correctly connected to a power source, check voltage between wire #1 and #8 on TB1 connector. Voltage should be between 24-32VDC. If outside limits, replace board.

4-5. Control Board - Corrective Procedure

1. Remove the ten screws securing the control panel to the unit.
2. Carefully pull the panel back by ½ inch, top end only, to expose the Terminal Blocks TB1 and TB2.
3. Disconnect the four wires from TB1 and 4 wires from TB2.
4. Remove control panel and place on a soft clean surface, face side down.
5. Desolder and remove two motor wires from J2
6. Disconnect connector J3.
7. Disconnect connector J4.
8. Remove 4 screws, washers and nuts holding the 12VDC power receptacle.
9. Remove 4 screws, washers and nuts holding the 24-28VDC power receptacle.
10. Remove 6 mounting nuts and washers holding the control board. Three nuts are located on the electronic board section, and three nuts secure an aluminum plate to the front panel.
11. Remove control board assembly.

4-6. Control Board - Replacement Procedure

1. Thoroughly clean the mating surface on the front panel.
2. Apply thermal grease to the bottom side of the aluminum plate of the new electronic board assembly.
3. Place board assembly on front panel.
4. Thread two motor wires through large board hole BH1 (Figure 6 Page 14).
5. Secure board with 6 washers and nuts.
6. Insert 12VDC and 24-28VDC connectors into front panel and secure with screws, washers and nuts.
7. Solder white motor wire to square board pad and black wire to round board pad.
8. Reconnect connectors J3 and J4.
9. Reconnect wires 1,4,5 and 8 to TB1.
10. Reconnect TUBE and BLOCK thermistor wires to TB2.
11. Secure the front panel with 10 screws to the unit.
12. Connect to power source and test.

Section 5 Power Supply

5-0. General

The rectifier power supply is designed specifically to provide the power to operate the M-30TR refrigerator from a 115VAC or 230VAC, 50/60Hz in sheltered environments. The input voltage is selectable by the AC select switch of the power supply, (Page 9 Figure 3).

5-1. Description and Specifications

The power supply is well protected within a closed metal box. Two cables extend from the unit. One cable connects the main AC source to the power supply, and one cable connects the power supply to the 24/28VDC receptacle of the M-30TR Control Panel marked 24/28VDC, (Page 10 Figure 4).

Electrical Parts List of power Supply PN A-7160

TR 201	TRANSFORMER	115/230 PRI;21.7 SEC. VDC
D 201	BRIDGE RECTIFIER	50V 25A
C 201	CAPACITOR	4900 MF, 50VDC
R 201	RESISTOR	2200 OHMS +10%, 5W
C-7110-03	CIRCUIT PROTECTOR CB-3	3 AMPS
S 201	VOLTAGE SELECT SWITCH	115/230VAC
P 201	PLUG	MS-3106A-18-01S

5-2. Installation

The power supply is mounted on the back of the M-30TR unit. When correctly mounted, the mounting latch will be on top. (Page 32 Figure 14). Insert the power supply slotted spacer plate into the mounting bracket on the back of the M-30TR unit and fasten the latch located on the top of the power supply assembly. (Page 32 Figure 14). Both cables, the main AC power cable and the DC power cable, will come out the bottom of the power supply when mounted correctly.

Connect the DC power cable to the 24/28VDC receptacle of the M-30TR front panel.

Set the AC selection switch to the correct AC voltage main, plug in to operate the unit.

NOTE: The power supply is supplied with a 115VAC plug. Connect an appropriate plug for operation in other locations.

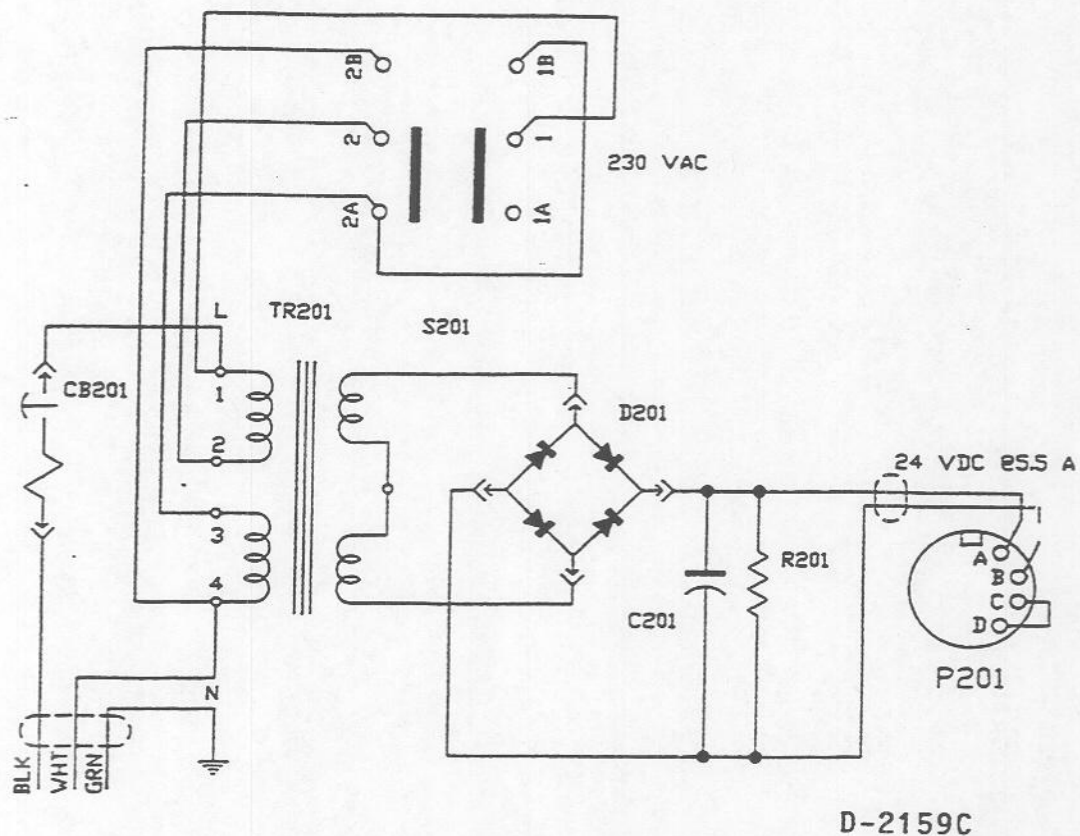


Figure 13
Power Supply , Schematic

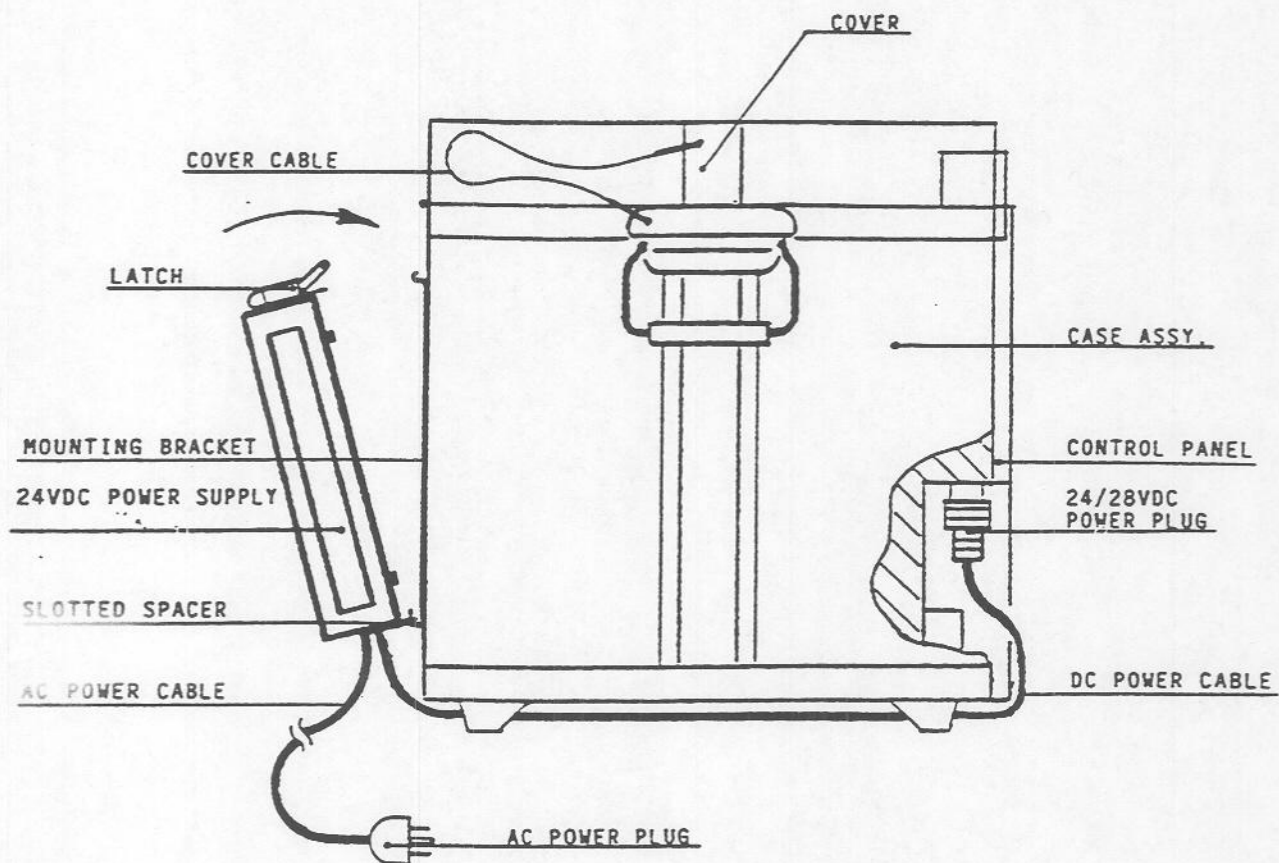


Figure 14
Attaching the Power Supply

Section 6 Hard Copy Recorder

6-0. General

The circular chart recorder is designed to record the load compartment temperature of the Thermopol Refrigerator N.S.N 4110-01-451-2356.

The temperature graph is printed on a hard copy, thermal paper chart P-2415-C by means of periodic heat pulses of the thermal print head. The temperature sensor of the recorder is a built-in integral part of the Thermopol Refrigerator.

Specifically developed for the recorder, the thermal print head is solid state and uses no moving parts.

The recorder chart turns at a rate of 1 turn per week. Measuring range is from -10°C to 20°C .

A microprocessor calculates average compartment temperature through numerous repetitive scans increasing reliability as well as accuracy.

6-1. Activation

Activation is automatically achieved by plugging the refrigerator to a correct power source.

To install the temperature chart P-2415-C, write the date of shipment on date box. Place chart on center pin gently (DO NOT push firmly). Align chart day and time with white mark — on front panel. Close door and lock fasteners 1/4 turn clockwise.

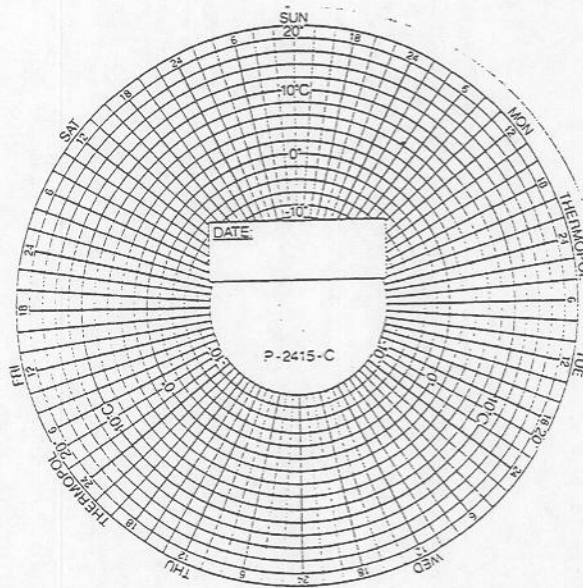


Figure 15
Temperature Chart

Section 7 Equipment

7-0. General

All equipment required for the operation of the M-30TR Thermopol Refrigerator in the United States is supplied with the unit. If, however, the unit is to be used in a geographical area in which the standard AC power is 230VAC, a local conversion plug must be used, and the power supply setting must be adjusted to 230VAC.

7-1. List of Supplied Equipment

Quantity	Description	Part #
1ea.	Refrigerator: M-30TR	A-7244
1ea.	Rectifier Power Supply	A-7160
1ea.	Wire Basket	A-2420
1ea.	Power Cable	A-2089
1ea.	Battery Pack	A-2321
50ea	Temperature Charts	P-2415-C
2ea.	Maintenance Manual	M-30TR-MM1
2ea.	Operational Manual	M-30TR-OP1

7-2. List of Required Equipment - Not Supplied.

NONE

Section 8 Installation

8-0. General

The following information should be used to assist in the prompt set-up of the M-30TR Blood and Vaccine Refrigerator. These directions for unpacking and installation will considerably ease initial set up, and avoid unnecessary mistakes.

8-1. Proper Location of Equipment

The M-30TR is designed to operate at ambient temperatures of between -40°C (-40°F) and 49°C (120°F) cycle as per Climatic Criteria AR 70-38; QSTAG 360.

8-2. Assembly Interconnections

The battery pack P.N. A-2321 should be mounted directly to the control panel. The two slotted screws should be securely fastened. When in storage, loosen the two slotted screws to disconnect the battery pack. (Page 8 Figure 2).

For AC operation, the rectifier power supply P.N. A-7160 can be mounted on the rear mounting bracket of the M-30TR Blood and Vaccine Refrigerator, (Page 32 Figure 14). It should then be connected to the 24/28VDC receptacle, located and marked on the control panel. The AC cable should be plugged into the correct AC main, (Page 9 Figure 3).

For DC operation, use the power cable P.N. A-2089, supplied with the M-30TR. Connect the cable between the DC power source and the corresponding connector located and marked on the Front Panel, (Page 8 Figure 2).

Note: When properly connected, the Green power indicator light should be on. No switching is needed.

Section 9 Operation

9-0. Initial Adjustments

The M-30TR is factory set for normal operation. No initial adjustments are necessary.

The power supply is factory set to 115VAC. If used at a 230VAC location, the Power supply must be set to local voltages. To adjust, use a flat screwdriver and move the slide switch to the 230VAC position, as indicated on the power supply.

NOTE: Connect an appropriate AC power plug for operation in other than 115VAC locations.

9-1. Starting, Operating and Stopping the Equipment

To start the operation of the M-30TR, the unit must be connected into an appropriate power source. Once the unit has been properly connected, the green power indicator light will be on. No switching or adjusting is necessary.

The connector receptacles, switches and indicators of the unit are all located on the control panel and are marked with their functions, (Page 10 Figure 4).

Steps for starting the unit in operation:

1. Source Voltage Determination

Ascertain available power source voltage: 115VAC, 230VAC, 12VDC or 24-28VDC.

2. Connection to Unit

Connect the M-30TR in accordance with the source voltage:

Source	Connection	Receptacle
12VDC	Power Cable PN A-2089	J2 - 12VDC
24/28VDC	Power Cable PN A-2089	J1 - 24VDC
115VAC or 230VAC	Power Supply Plug	J1 - 24VDC

3. Installation of Alarm Battery Pack

Install a charged battery pack in the front panel recess, (See Page 8 Figure 2). The indicator of the compartment thermometer will light. If the battery voltage is low, no light will appear on the thermometer. The battery pack will charge automatically when power is provided to the unit. To ascertain the performance of the battery pack, disconnect the M-30TR after approximately 15 minutes and observe the light on the thermometer, indicating proper operation.

Note: The alarm, thermometer and recorder will operate with or without the battery pack when power is provided to the unit.

4. Alarm/Battery System Test

Push the lever of the alarm switch, located on the control panel, up to the test position. The temperature indicators will light momentarily. The red alarm light will blink and the sound signal will beep. Push the lever of the alarm switch down to the reset position. The alarm mode will be off.

5. Connection to DC voltage

For 12VDC or 24-28VDC, the red positive clip of the D.C. power cable must be connected to the positive (+) contact of the source, and the black negative clip, to the negative (-) contact of the source.

6. Connection to AC Voltage

For AC operation, the power supply is plugged into an AC main. **Check and set correct voltage of the Power supply before connecting the M-30TR.**

When correctly connected and powered, the green power indicator on the control panel will light, and the M-30TR will be in operation. The compartment temperature will be indicated by the color coded, solid state thermometer changing from red to yellow to green in the normal range. The DC plug of the power supply must be connected to the 24/28VDC receptacle of the M-30TR front panel, (Page 32 Figure 14).

Steps for normal operation

Operation is maintenance-free. As long as the unit is properly connected to a correct power source, it will maintain a compartment temperature of 2°C (35.6°F) to 6°C (42.8°F).

Steps for stopping operation

Stopping the equipment requires unplugging it from its power source. It is advisable to remove the battery pack while unit is not in operation. If the unit is to be idle for an extended period of time, it is advisable to thoroughly wash the compartment with soap and water prior to storage.

9-2. Storage

The M-30TR may be stored in a normally vented storage facility. Storage environmental temperature of -40°C (-40°F) to 71°C (160°F) is acceptable.

SHORT TERM:

Clean the unit's load compartment with a mild detergent. Store power cable, power supply, battery pack and recorder inside the clean load compartment.

LONG TERM:

Same as above. In addition, clean outside of unit by blowing an air stream over the unit. Blow dust and dirt from the 4 Heat Sinks located in the 4 corners of the unit, (Page 8 Figure 2). Place in a carton or cover with a plastic bag. Place in a sheltered area.

Section 10

List of Replacement Parts

Thermopol Part Number	Manufacturer	Manufacturer Part Number	Description	Quantity	Location Ref.
A-2219	Thermopol		Case Assy	1	Page 8 Fig 2
P-2261	Thermopol		Rim	1	Page 8 Fig 2
P-2239	Thermopol		Hinge	1	Page 9 Fig 3
C-2091	Thermopol		Latch (Catch)	2	Page 8 Fig 2
P-2264	Thermopol		Handle	2	Page 9 Fig 3
P-2258	Thermopol		Cover, Corner	4	Page 8 Fig 2
A-2435	Thermopol		Cover Door Assy	1	Page 9 Fig 3
P-2063	Thermopol		Gasket, Cover	1	Page 8 Fig 2
P-2257	Thermopol		Bracket, Strike	1	Page 8 Fig 2
C-2091-1	Thermopol		Latch	2	Page 8 Fig 2
P-2097	Thermopol		Door Cable	1	Page 8 Fig 2
P-2239	Thermopol		Hinge	1	Page 9 Fig 3
A-2436	Thermopol		T.E. Assembly	3	Page 8 Fig 2
A-7437	Thermopol		T.E./Sensor Assembly 1		Page 8 Fig 2
NOTE: In Corner #1 only!					
A-7211	Thermopol		Control Panel Assembly1		Page 8 Fig 2
A-7205	Thermopol		Control Board Assy	1	Page 14 Fig 5
P-7211	Thermopol		Panel, Front Assy	1	Page 8 Fig 2
C-7110-08	Airpax	PR15-62-8.00A-XX	Circuit Protector CB-8	1	Page 10 Fig 4
C-4105	Mallory	SC628M	Audio Alarm Signal	1	Page 10 Fig 4
C-4104	Cutler Hammer	8834K5	Alarm Test/Reset Switch1	1	Page 10 Fig 4
C-4106-1	Dialight	24979673332504	Visual Alarm Signal	1	Page 10 Fig 4
C-4106-2	Dialight	24978673332504	Power Indicator	1	Page 10 Fig 4
P-2214	Thermopol		Interlock	1	Page 10 Fig 4
C-2370	Haydon Switch	A31317-28	Stepper Motor	1	
P-2415	Thermopol		Paper Chart	1	Page 33 Fig 15
A-7160	Thermopol		Power Supply	1	Page 32 Fig 14
C-2312	Trasnova	C-2312	Transformer	1	Page 31 Fig 13
C-4107	Motorola	MB2505	Rectifier	1	Page 31 Fig 13
C-4108	C & K	V802-12-SS-05-Q	Voltage Select Switch	1	Page 31 Fig 13
C-4109	Mallory	CGS492U050R3L3PH	Capacitor	1	Page 31 Fig 13
C-7110-03	Airpax	PR11-52-3.00A-XX-V	Circuit Breaker	1	Page 31 Fig 13
A-2439	Thermopol		24V Power Cable Assy	1	Page 31 Fig 13
A-2440	Thermopol		Line Power Cable Assy	1	Page 31 Fig 13
C-2091-1	Nielsen	HC83314800CEODCUTHLS	Latch	1	Page 32 Fig 14
A-2321	Thermopol		Battery Pack	1	Page 10 Fig 4
A-2089	Thermopol		Power Cable	1	Page 8 Fig 2
A-2420	Thermopol		Wire Basket	1	Page 8 Fig 2
A-7223	Thermopol		Thermistor Probe Assy1		Page 8 Fig 2
M-30TR-MM1	Thermopol		Maintenance Manual	2	
M-30TR-OP1	Thermopol		Operational Manual	2	

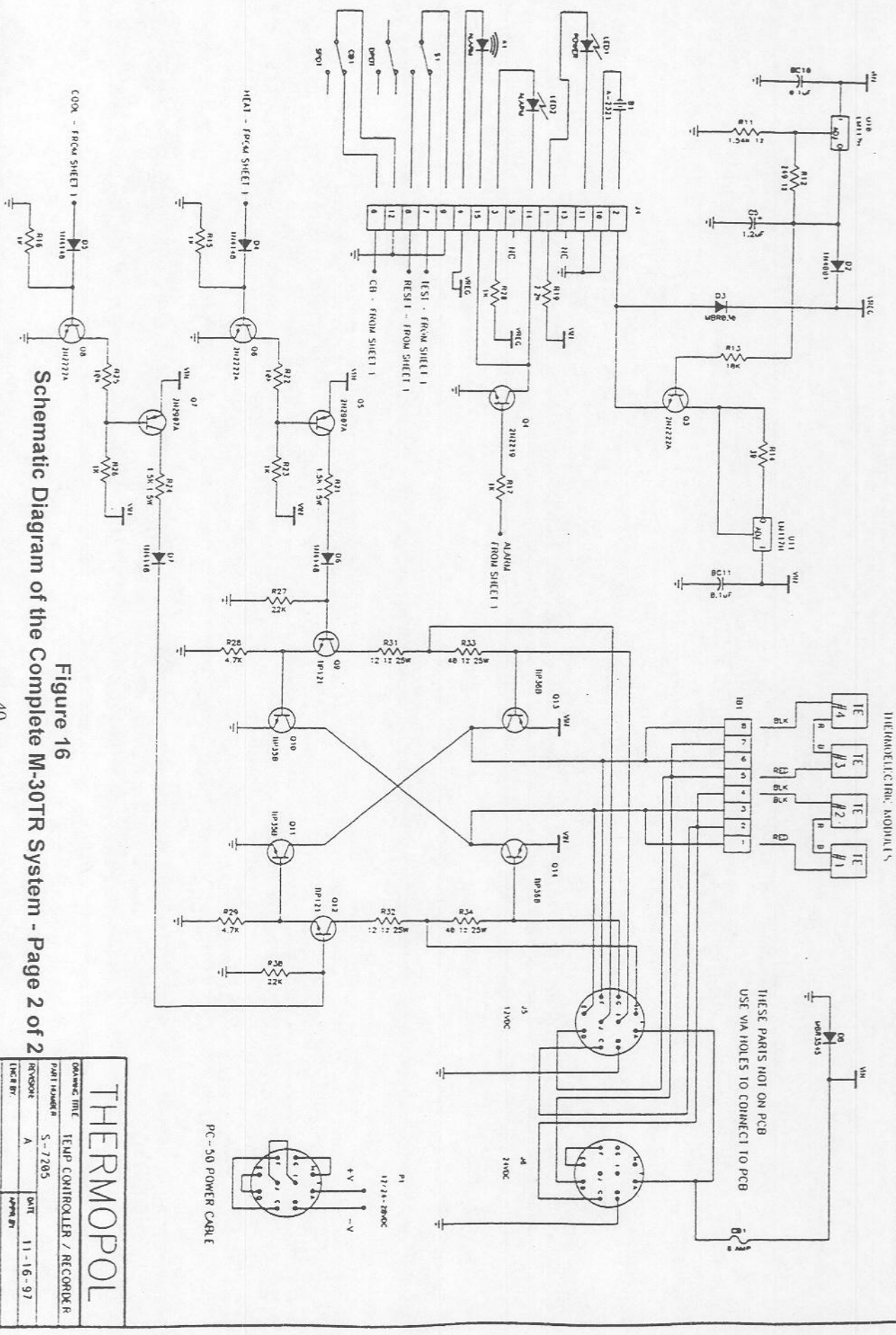


Figure 16
Schematic Diagram of the Complete M-30TR System - Page 2 of 2

THERMOPOL			
TEMP CONTROLLER / RECORDER			
PART NUMBER	S-7205	DATE	11-16-97
REVISION	A	APPROVED BY	
FILE NAME	THE RMOPOL.S92	SHEET	2 of 2